THE INFLUENCE OF THE LEVEL OF WINTER NUTRITION ON THE SUBSEQUENT PERFORMANCE AND CARCASS CHARACTERISTICS OF BEEF CATTLE

by

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INTRODUCTION

Steer calves are used quite extensively by Kansas producers in a wintering, grazing, and fattening program or some variation of it. They are usually quite plentiful in the fall of the year weighing between 350 and 450 pounds. Calves of this weight will make a large growth gain while utilizing a maximum of roughage and a minimum of grain and other more costly feeds. They are purchased in the fall when a good estimate of feed available can be made. Calves can also be wintered on less feed than older cattle and take advantage of their natural growth impulse.

Dry bluestem pasture has been used successfully for several years as a low cost source of winter roughage for steer calves that are to be grazed during the summer and sold off grass as feeder or stocker yearlings.

Experiment I reported here was planned so as to compare the performance of steer calves wintered on bluestem pasture with those wintered on good quality roughage in a wintering, grazing, and fattening program with regard to the effect on total performance and especially with respect to the effect on the carcasses produced.

Yearling steers are also used by Kansas producers in a wintering, grazing, and fattening program or some variation of it. They can usually be purchased at a lower price per pound than steer calves and may be finished with a slightly shorter feeding period in the fall. They consume large quantities of roughage, however, which may increase their feed cost considerably in the

wintering phase. This study was concerned also with lowering the cost of wintering yearling steers by introducing the use of low cost winter grass, and observing its effect on future performance, especially with regard to the effect on the carcass produced, as compared with yearling steers wintered on good quality roughage in the production of "good" to "choice" grade, 1200 pound slaughter steers.

The objective of this study then was to determine the effect of wintering on total gains, carcass grade and desirability, dressing percentage, and margin of profit using steer calves in Experiment I and yearling steers in Experiment II.

The trials varied from a low level of wintering to a good level of wintering and were followed first by a grazing period, then with a full feeding period of about 80 days for the yearling steers and 100 days for the steer calves.

REVIEW OF LITERATURE

An animal is similar to a machine in that it has been found to be most efficient when operating at full capacity. A certain amount of total feed eaten is required for maintenance of the body, and this must be furnished before fattening takes place. Guilbert and Hart (1946) used three levels of nutrition to illustrate this efficiency at full capacity. Steers fed grain on pasture to promote gain and finish weighed 900 pounds in less than 14 months and graded choice. Under a more practical approach, steers fed 300 pounds of supplemental feed gained continuously to attain a weight of 900 pounds in 21 months in a fleshy feeder

condition. Steers of the same quality and on the same range feed receiving no supplemental feed required 31 months to reach 900 pounds. They not only required more feed, but also incurred added interest, risk, and other costs, and yielded a product of lower value.

Winchester and Howe (1955) made a study of the relative effects of liberal and restricted feed intakes on total gains of six pairs of monozygotic (identical) twins. The steers gained a pound a day on 75 per cent of a liberal ration, one-half pound per day on a 62 per cent ration and generally maintained their weight on the maintenance allowance. After this six-month period of restricted intake, the animals wintered on the restricted ration gained weight rapidly and economically. Slaughter weight of 1000 pounds was reached on approximately the same energy intake for all groups of steers. Animals fed restricted diets required from ten to 20 weeks longer to reach slaughter weight.

In partial agreement with this, Morrison (1956) stated that ruminants digest their food more completely when fed a maintenance ration than when fed a liberal amount of the same feeds. However, when fed a considerable amount of roughage they may digest a full feed as completely as a subsistance feed. Cattle fed a ration complete in essential body nutrients and only enough energy to maintain body weight, continued to grow in height for 70 to 120 days at a rate equal to that of comparable cattle fed liberally. Growth rate decreased and ceased at from six months to a year and a half. Animals were not permanently stunted unless underfeeding was continued for an extended period. Liberal

feeding after such a period of sub-normal feeding usually resulted in rapid gains on less feed per 100 pounds gain. This indicated that it might be profitable to winter growing animals on roughages and good quality protein supplement and take advantage of the rapid and economical gains on pasture.

Lush et al. (1930) plotted skeletal growth and weight gains for growing range cattle. It was found that some skeletal growth was independent of the season for its continuation, whereas other skeletal growth was slowed down during the low plane of nutrition of the winter months. Weights of growing range cattle increased very rapidly from mid-April to mid-July and continued in some years until early December if properly supplemented. Rate of increase usually slowed down from late summer to early winter. From mid-October to mid-January weights usually increased only a little and actual loss occurred from mid-January to early March, which was barely regained by mid-April. Variations from this growth pattern were directly influenced by weather fluctuations.

Knapp (1942), in agreement with Lush (1930) mentioned above, reports that this general stairstep pattern of growth appears to be normal for cattle in the Great Plains area.

It was also found by Sheets and Tuckwiller (1926) that between the end of the plant growing season and the start of the winter feeding phase there was a loss in weight. It usually took about all of the winter gain to make up this loss, so that the steers going on grass in the spring weighed about the same as they had at the end of the growing season the previous fall.

Using early and late cut native hay, Bohman (1955) showed that over a two-year period the level of wintering had no effect on total weight gains. Significantly greater gains were made by the cattle fed early cut hay during the winter feeding period. Those wintered on late cut hay gained significantly more on grass the following summer but were still significantly lighter in weight. As yearlings grazed a second year, the cattle fed on late cut hay completely compensated for the two winters of restricted growth and weighed as much as the animals wintered on the better quality forage.

It was concluded by Winchester and Howe (1955) that under conditions of feed scarcity, beef cattle between the ages of six and 12 months could be carried at an energy level as low as maintenance, if nutritional needs other than energy were supplied. No later loss occurred in efficiency of feed utilization, meat quality, or desirability of carcass.

Sheets (1924) stated that cattle to be marketed early should be wintered on a relatively high plane of nutrition, whereas cattle to be grazed all summer, or fattened after the grazing period, should be wintered on a lower plane of nutrition and take advantage of higher gains on grass. There were usually only small differences at the end of the grazing season and cost of the ration must be taken into consideration when making conclusions as to the best winter ration.

It was found by Stephens et al. (1949) that steers wintered on a high plane of nutrition lost weight during the first four weeks on pasture, whereas those wintered on a lower plane gained

as much as two pounds per head per day for the same period.

Snapp (1952) stated that "The amount of gain made in summer varies inversely with the amount of gain made during the winter". The winter ration, therefore, should prepare cattle for making maximum use of the summer ration. Cattle to be grazed till mid-summer and then full fed should be wintered on a higher plane than if they are to be grazed all summer; if they are to be fed on pasture they should be wintered better than if grazed alone.

Kincaid (1939) noted that there was a significant negative correlation between winter gain or loss and summer gain on grass with yearling steers. About one-third of the variance of summer gains was due to winter weight changes. Total gains were higher for those having the highest winter gain.

These observations by Snapp and Kincaid were in general agreement with the findings of several other workers. Steers making only slight gains or losing weight in winter made the greatest summer pasture gains; steers making larger winter gains, made larger total gains for the year; differences in weight at the end of winter due to plane of nutrition are gradually minimized during summer grazing but are never fully overcome according to the findings of Sheets and Tuckwiller (1924). This was in agreement with work done by Sheets (1924), Sheets and Tuckwiller (1926), Black (1927), Darlow et al. (1948), Stephens et al. (1949), Dyer (1952), and Nelson and Campbell (1954).

Black (1927) and Black et al. (1939) concluded that if steer calves are to be developed into two year old feeder steers by the use of native summer range, they should be wintered to gain from

25 to 50 pounds per head, and yearlings should be kept in a thrifty condition on a plane slightly above maintenance.

Kincaid et al. (1945) found that each pound of winter gain reduced summer gain by .58 of a pound and increased annual gain by .42 of a pound.

Connell et al. (1947) wintered steer calves on dry sorghum roughage and cane silage rations. Protein supplement added to these rations stimulated appetite and greatly increased gains at a feed cost of only six to eight cents per pound of extra gain. At the end of a six-month grazing period, the difference in weight gains was greatly reduced and the cost per pound of the extra gain was about 18 cents. By the end of the fattening phase it was still further reduced and amounted to 22.3 cents per pound of extra gain. Using Morrison's energy tables and expressing in terms of feed replacement, the value of the protein supplement fed during the winter was increased seven times based on the winter gain only. This replacement value was lost by the end of summer. From a practical standpoint, it would have paid to feed protein supplement if calves were sold at the end of the wintering period, but its value was questionable if calves were carried through grazing and fattening phases.

Using a three phase feeding system, Guilbert et al. (1944) found that 200 to 300 pounds of supplemental feed given to weanling calves on dry grass results in about 100 pounds of additional weight. During the first phase, weanling calves on dry grass, supplemented with cottonseed cake and rolled barley, gained a pound to a pound and a quarter daily for a total gain of 195

pounds; unsupplemented calves lost about 20 pounds per head. During the second phase, the previously unsupplemented lot was fed supplemental feed while on good grass and the first group received grass only. They gained 300 and 180 pounds respectively. At the end of the fattening period, steers fed concentrates during the first phase weighed 95 pounds more than those supplemented in the second phase. It would have required 40 to 50 additional days and approximately 400 to 450 pounds each of concentrates and harvested roughage for the lighter steers to gain this additional weight.

Supplemental feed given to weanling calves reduced feed lot finishing time, returned a greater profit, and produced a maximum amount of human food from feed available.

Johnson et al. (1952) found that the rate of gain and the feed requirements of steers during the full feeding phase were not affected by the level of nutrition during the winter period following 120 to 150 days on irrigated mixed grass and legume pastures. The total winter and pasture gains of steers wintered on a low-feed level were lower than that of steers wintered on a higher level of nutrition. Based on Morrison's nutrient values, 77.6 per cent of the total nutrients were furnished by roughage and grass.

Stephens et al. (1949) noted that winter gains appeared to have little influence on gains made in the feed lot after a period of early summer grazing. From an economic standpoint, finish, and overall gain, the producer who expects to graze yearling steers during the early summer would find that a winter gain of

from one-half to three-fourths of a pound per head daily will result in the most satisfactory gains on grass.

Guilbert et al. (1944) stated that from the standpoint of total feed required to produce a unit of product, greatest efficiency is obtained from a high plane of nutrition, with continuous growth and development. "The degree of approach to the ideal that may be made under specific conditions depends upon the relative costs of different phases of production."

The winter feed bill normally accounted for two-thirds of the yearly feed cost for calves according to Sheets and Tuckwiller (1922), and Black (1927). Therefore the winter feed cost largely determined the profit returned. It was important to feed the proper combination of feeds in the winter ration to produce satisfactory gains at the lowest cost. Usually the economy of gain was increased when the bulk of weight gain was made on grass.

Research by Dyer (1952) indicated that yearling cattle wintered on a high level require less corn to grade "choice" than calves wintered on dry bluegrass when both were grazed on similar pasture during the summer.

Black and Clark (1938) found that yearling steers wintered on dry range with supplemental feed returned more profit than those wintered in dry lot on straw and protein. The increased cost of gain was easily offset by the increased sales value of the steers as a result of more finish. Using prairie hay instead of straw, Nelson and Campbell (1954) found that the cost of adding corn to a winter ration of prairie hay and cottonseed cake was greater than the resulting increase in value of the steer

after grazing and full feeding.

McCampbell and Weber (1942) compared wintering heifer calves on good quality roughage and one pound of cottonseed meal and the same ration with the addition of three to four pounds of grain. After the grazing and full feeding period, the net return was in favor of the heifers fed no grain. They consumed more roughage and less grain but required ten days longer to reach the same degree of finish.

In the production of two year old steers to be marketed off grass, Nelson et al. (1951) found that the greatest net return was made by steers rough wintered on dry grass with supplemental protein, and grazed on pasture without grain during the summer. Nelson et al. (1952) noted that it was not as profitable to feed three pounds of grain during the winter phase or to feed grain on pasture as compared to no grain at all when steers were wintered, grazed, then fattened.

In the northern Great Plains, Black and Mathews (1937) found that it was more economical to winter two year old steers on the range and supplement them with concentrates and dry roughages in extremely bad weather or when snow covers the vegetation than to winter in dry lot.

Dyer and Guyer (1950) compared wintering on roughage alone, roughage supplemented with protein, and roughage plus a grain mixture in a three phase system of wintering, grazing on wheat-lespedeza pasture, and full feeding. Rate of gain on pasture was in reverse order to the rate of gain in winter. Because all cattle weighed about the same at the end of the grazing period and

the same amount of grain was required to fatten to the same grade, the most satisfactory and economical ration proved to be the roughage alone.

Duncan et al. (1951) found that pasture wintered cattle produced slightly more total gain at a lower cost than cattle wintered in dry lot on silage and hay.

Winchester and Howe (1955) found that interruption of growth due to a period of relatively low energy intake did not appreciably lower carcass grades, meat quality, quantity of lean meat, or dressing per cent. This is in partial disagreement with McCampbell et al. (1940), who found that the feeding of four and one-half pounds of grain to steer calves on a wintering ration produced significant improvement in appearance and selling price.

Guilbert et al. (1944) observed that steer calves making continuous gains had heavier hindquarters after fattening than calves whose growth was retarded after weaning. The hindquarters make up the higher priced retail cuts and results in a higher total carcass value. There was no significant difference in average fatness of the two groups.

Hedrick et al. (1954) fed steers at various planes of nutrition to give three levels of winter gain; 1.5, 1.0, and minus 0.4 pound per head daily. All steers were grazed during the summer and finished in dry lot to grade choice. Carcasses from cattle on the low plane of winter nutrition had more separable fat, less separable lean, and less fat in the rib eye at the 9-10-11th rib than carcasses from the cattle on the higher plane of nutrition. A palatability committee found no significant difference in

tenderness. Shear tests corroborated the results of the panel. Carcasses from steers wintered on a lower plane of nutrition grade lower and showed greater grade variability.

Sheets (1924) noted that shrinkage in transit to market ranged from 4.8 to 6.3 per cent with no definite trend in favor of high or low levels of wintering. Numbers were not considered to be sufficiently large for drawing conclusions relative to the methods of winter feeding, but the steers making the largest total gain tended to have a higher dressing per cent.

Comparing two year old steers wintered in the pasture with steers wintered in dry lot, Duncan et al. (1951) found only slight differences in carcass characteristics after a grazing and fattening period. Steer carcasses from animals receiving supplemental feed were less than one-third of a grade higher than those wintered without supplement.

EXPERIMENT I

Dry bluestem pasture has been used successfully several years at the Kansas Agricultural Experiment Station as a source of winter roughage for steer calves that were to be grazed during the summer and sold off grass as feeder yearlings. This study was to determine if dry grass could be supplemented in such a manner that calves would compare favorably in total performance with steer calves wintered on good quality roughage in a wintering, grazing, and fattening program.

Experimental Materials, Methods and Procedure

Three trials were conducted with good to choice Hereford steer calves originating in east central New Mexico. They were purchased as weanling calves and shipped by rail to Manhattan, Kansas where they were maintained chiefly on silage, prairie hay, and one pound of protein concentrate per head daily until they were placed on experiment.

Each year two lots were fed, one lot received dry bluestem pasture and the other lot received good quality sorghum silage. Both lots were supplemented with one pound of soybean oil meal and approximately four pounds of ground sorghum silage, except in Trial II where both lots received 4.8 pounds of ground sorghum grain per head daily.

They were individually weighed two consecutive days just before the start of a trial. The average of the two weights was used in allotting them so that as nearly as possible all lots in the same trial were about equal in weight and quality. The average weight for the three trials was 459 pounds and the average date placed on experiment was December 3. Weights ranged from 382 pounds in 1955-56 to 550 pounds in 1957-58.

During the wintering phase cattle were fed once daily, and during the full feeding phase in dry lot they were fed morning and evening. In Trial II the steers were grazed together during the summer grazing period. In the other two trials they were grazed in separate comparable pastures.

Water was heated during the winter to prevent ice forming in

the dry lot pens. The ice had to be chopped and removed from the tanks in the pastures used to winter the steers on dry grass. Salt and water was provided free choice at all times in all phases.

In Trial I, four of the steers in each lot were implanted with 36 mgs. of stilbestrol at the start of the test. Five steers in each lot were implanted with 24 mgs. in Trial II.

The longest wintering period was 158 days in duration in Trial II, while the shortest was 140 days in Trial III, averaging 151 days. The longest grazing period was 106 days in Trial III and the shortest was 77 days in Trial II, averaging 92 days. For the full feeding period Trial II was the longest with 128 days and the other two trials were the same, 99 days for an average of 109 days.

The carcass data was acquired by college personnel with the cooperation of the packers buying the animals. The carcasses were graded and scored by an official United States Department of Agriculture meat grader each year.

The following United States Department of Agriculture grades for beef cattle were used: prime, choice, good, commercial, utility, cutter, and canner. Each grade was divided into a third of a grade as top, average, or low for that grade. A numerical value was assigned to each third of a grade, starting with one for low canner and working up to 21 for top prime. The higher numerical grade denoting a higher carcass grade.

For the following carcass scores a lower number denotes a more desirable characteristic and are scored as follows:

Visual marbling of rib eye: moderate, 5; modest, 6; small amount, 7; slight amount, 8; traces, 9.

Visual fat thickness at the twelfth rib: moderate, 3; modest, 4; slightly thin, 5.

Visual rib eye size at twelfth rib: moderately large, 3; modestly large, 4; slightly small, 5.

Firmness of rib eye at twelfth rib: firm, 2; moderately firm, 3; modestly firm, 4; slightly firm, 5.

Dressing per cent was based on weights at the Kansas Station and warm carcass weights.

In Trial I, the only difference in treatment of the two lots was during the wintering phase. Lot 18 was wintered in dry lot on sorghum silage and lot 15 was wintered on dry bluestem pasture. (Table 2). There were nine steers in lot 18 and eight in lot 15. Grain and protein supplement was discontinued in lot 15 after April 14, 1956. The steers were weighed off test November 10 due to a shortage of pen space and fed together until they graded choice on foot. December 30, 1956, four steers from lot 15 and two steers from lot 18 were shipped to market. January 28, 1957, four steers from lot 15 and six from lot 18 were shipped. One steer from lot 18 died, cause unknown, December 27, 1956.

In Trial II, the only difference in treatment between lot 1 and 2 was during the wintering phase. Lot 1 was wintered in dry lot on sorghum silage and lot 2 was wintered on dry bluestem pasture. (Table 3). There were ten steers in each lot, one steer was removed from lot 1 during the fattening period because of an injury.

In Trial III, the only difference in treatment of the two lots was during the wintering phase. Lot 22 was wintered in dry lot on sorghum silage and lot 12A was wintered on dry bluestem pasture. (Table 4). There were ten steers in each lot.

Table 1. Yearly feed prices for Experiment I for the years 1955-58.

Year	Sorghum Grain Per Cwt	Soybean Pellets Per Ton	Alfalfa Hay Per Ton	Sorghum Silage Per Ton	Summer Grass Per Head	Dry Grass Per Head Monthly
1955-56	$2.35	$70.00	$20.00	$6.50	$16.00	$.50
1956-57	2.50	70.00	25.00	6.00	16.00	.50
1957-58	2.00	67.00	16.00	7.00	16.00	.50
Average	2.28	69.00	20.33	7.17	16.00	.50

Experimental Results and Discussion

In Trial I, 1955-56, the steers in lot 18, fed good quality roughage, gained 105 pounds more per head during the winter period than the steers wintered on pasture, but gained 90 pounds less during the summer pasture period which greatly minimized the larger winter gains. Lot 18 gained 13 pounds more and consumed less feed per 100 pounds gain during the fattening phase than lot 15, wintered on dry grass.

For the complete trial the steers in lot 18, wintered on good quality roughage, gained 28 pounds more per head and dressed 1.3 per cent more. The steers in lot 15, wintered on dry grass, had a $2.00 lower feed cost per 100 pounds gain and graded as high as the steers wintered on good quality roughage. This

Table 2. Trial I. A comparison of wintering in dry lot with wintering on dry bluestem pasture for steer calves on a wintering, grazing, and fattening program. (1955-56)

Lot number	18	15
Number of steers in test	9	8
Phase 1 - Wintering, 155 days	Dry lot	Pasture
Initial wt. per steer, lbs.	386	379
Gain per steer	275	170
Av. daily gain per steer	1.7	1.1
Daily ration per steer, lbs.		
Ground sorghum grain	4.0	3.7
Soybean pellets	1.0	1.0
Sorghum silage	29.8	--
Dry bluestem pasture	--	Free choice
Salt and bonemeal	.08	.11
Phase 2 - Grazing, 92 days		
Initial wt. per steer, lbs.	661	549
Gain per steer	91	181
Av. daily gain per steer	0.99	1.97
Phase 3 - Full feeding, 99 days		
Initial wt. per steer, lbs.	752	730
Gain per steer	231	218
Av. daily gain per steer	2.33	2.20
Av. daily ration per steer, lbs.		
Ground sorghum grain	16.4	16.0
Cottonseed meal	1.9	1.9
Prairie hay	4.6	4.8
Ground limestone	.1	.1
Feed cost per 100 lbs. gain	$21.77	$22.64
Summary of Phases 1, 2, and 3, 346 days		
Final wt. per steer	983	948
Total gain per steer	597	569
Av. daily gain per steer	1.72	1.64
Feed cost per 100 lbs. gain	$17.14	$15.15
Necessary selling price per cwt. to cover initial cost plus feed cost	$19.24	$18.09
Av. dressing per cent	62.8	61.5
Av. U.S.D.A. carcass grade	13.1	13.3

enabled them to make a higher return above initial cost plus feed cost. Carcass data other than grade and dressing per cent were not obtained in this trial.

In Trial II, 1956-57, the steers in lot 2, wintered on dry grass, gained 77 pounds less during the winter period than the steers in lot 1, wintered on high quality roughage, but gained 32 pounds more during the summer grazing period and 26 pounds more during the fattening phase.

The pasture wintered steers made more efficient use of the feed during the fattening period, and had a $1.64 lower feed cost per 100 pounds gain. The steers wintered on good quality roughage gained 19 pounds more per head for the entire trial, sold for $1.41 more per hundred weight based on carcass value, returned $7.60 more per head, dressed 1.24 per cent more, graded more than one-third of a grade higher, and produced a superior carcass based on carcass scores.

In Trial III, 1957-58, the steers in lot 22, fed high quality roughage in dry lot, gained 119 pounds more per head during the winter period than the steers wintered on pasture, but gained 112 pounds less during the summer pasture period, which made the winter and summer gain combined about the same for both lots.

The gains were approximately the same during the fattening period and only small differences were observed in efficiency of gain. The steers wintered on pasture consumed slightly more grain with little increase in gain which increased their feed cost per 100 pounds gain slightly.

Table 3. Trial II. A comparison of wintering in dry lot with wintering on dry bluestem pasture for steer calves on a wintering, grazing, and fattening program. (1956-57)

Lot number	1	2
Number of steers in test	10	10
Phase 1 - Wintering, 158 days	Dry lot	Pasture
Initial wt. per steer, lbs.	445	445
Gain per steer	222	145
Av. daily gain per steer	1.41	0.92
Daily ration per steer, lbs.		
Ground sorghum grain	4.8	4.8
Soybean meal	1.0	1.0
Sorghum silage	25	--
Dry bluestem pasture	--	Free choice
Salt	.05	.05
Phase 2 - Grazing, 77 days		
Initial wt. per steer, lbs.	667	590
Gain per steer	103	135
Av. daily gain per steer	1.33	1.75
Phase 3 - Full feeding, 128 days		
Initial wt. per steer, lbs.	777[1]	725
Gain per steer	302	328
Av. daily gain per steer	2.36	2.56
Av. daily ration per steer, lbs.		
Ground sorghum grain	17.4	17.5
Soybean meal	1.5	1.5
Alfalfa hay	2.8	2.7
Salt	Free choice	Free choice
Feed cost per 100 lbs. gain	$22.12	$20.45
Summary of Phases 1, 2, and 3, 363 days		
Final wt. per steer	1079	1053
Total gain per steer	627[1]	608
Av. daily gain per steer	1.74	1.67
Feed cost per 100 lbs. gain	$19.64	$18.11
Av. selling price per cwt. based on carcass value	$24.80	$23.39
Return above initial cost and feed	$33.93	$26.33
Av. dressing per cent	61.72	60.48
Av. U.S.D.A. carcass grade	13.8	12.3
Marbling score	5.7	7.0
Fat thickness score	4.0	4.5
Rib eye size score	4.0	4.6
Firmness score	3.2	4.1

[1]One steer removed during the fattening period due to an injury.

Table 4. Trial III. A comparison of wintering in dry lot with wintering on dry bluestem pasture for steer calves on a wintering, grazing, and fattening program. (1957-58)

Lot number	22	12A
Number of steers in test	10	10
Phase 1 - Wintering, 140 days	Dry lot	Pasture
Initial wt. per steer, lbs.	551	550
Gain per steer	182	63
Av. daily gain per steer	1.3	0.45
Daily ration per steer, lbs.		
Ground sorghum grain	4.0	4.0
Soybean meal	1.0	1.0
Sorghum silage	11.9	--
Alfalfa hay	8.4	--
Dry bluestem pasture	--	Free choice
Phase 2 - Grazing, 106 days		
Initial wt. per steer, lbs.	733	613
Gain per steer	90	212
Av. daily gain per steer	0.85	2.0
Phase 3 - Full feeding, 99 days		
Initial wt. per steer, lbs.	823	825
Gain per steer	297	307
Av. daily gain per steer	3.0	3.1
Av. daily ration per steer, lbs.		
Ground sorghum grain	19.8	22.0
Soybean meal	1.0	1.0
Alfalfa hay	5.2	5.2
Salt	Free choice	Free choice
Feed cost per 100 lbs. gain	$19.89	$20.84
Summary of Phases 1, 2, and 3, 345 days		
Final wt. per steer	1120	1132
Total gain per steer	569	582
Av. daily gain per steer	1.65	1.69
Feed cost per 100 lbs. gain	$20.18	$17.18
Av. selling price per cwt. based on carcass value	$44.88	$44.10
Return above initial cost and feed	$49.84	$58.81
Av. dressing per cent	62.0	61.2
Av. U.S.D.A. carcass grade	17.3	16.4
Marbling score	5.7	7.0
Carcass conformation grade	19.3	19.4
Before ribbing carcass grade	17.3	17.0

For the three phases, the steers in lot 12A, wintered on dry grass, gained 13 pounds more per head, had a $3.00 lower feed cost per 100 pounds gain, and returned $8.97 more per head. The steers wintered on good quality roughage in dry lot sold for $.78 more per hundred weight based on carcass value, dressed 0.8 per cent more and graded one-third of a grade higher, producing a slightly superior carcass.

Summary of Experiment I

The steers wintered on good quality roughage produced more desirable carcasses, sold for more per hundred weight, and dressed 1.11 per cent more than pasture wintered steers on an average in all trials. They made a greater total gain in the first two trials and graded more than one-third of a grade higher on the average for all trials, however in Trial I they graded the same as the steers wintered on dry grass. The pasture wintered steers had a lower feed cost per 100 pounds of gain in all three trials, had a higher financial return except in Trial II, and made a greater total gain in Trial III than the steers wintered in dry lot.

The steers wintered on good quality roughage gained 100 pounds more on the average during the winter period, 81 pounds less during the summer grazing period, and eight pounds less during the fattening phase. In two of the three trials the steers wintered on pasture gained slightly more during the fattening period than the steers wintered on good quality roughage.

Table 5. A comparison of wintering in dry lot with wintering on dry bluestem pasture for steer calves. A summary of three trials, 1955-56, 1956-57, and 1957-58.

Number of steers in test	27	28
Phase 1 - Wintering, 151 days	Dry lot	Pasture
Initial wt. per steer, lbs.	461	458
Gain per steer	226	126
Av. daily gain per steer	1.49	0.83
Daily ration per steer, lbs.		
Ground sorghum grain	4.26	4.16
Soybean oil meal	1.0	1.0
Sorghum silage	22.2	--
Dry bluestem pasture	--	Free choice
Salt and bonemeal	.06	.07
Phase 2 - Grazing, 92 days		
Initial wt. per steer, lbs.	687	584
Gain per steer	95	176
Av. daily gain per steer	1.03	1.91
Phase 3 - Full feeding, 108 days		
Initial wt. per steer, lbs.	782	760
Gain per steer	276	284
Av. daily gain per steer	2.54	2.62
Av. daily ration per steer, lbs.		
Ground sorghum grain	17.8	18.5
Soybean oil meal	1.46	1.46
Alfalfa hay	4.2	4.2
Salt	Free choice	Free choice
Feed cost per 100 lbs. gain	$21.22	$21.15
Summary of Phases 1, 2, and 3, 351 days		
Final wt. per steer, lbs.	1058	1044
Total gain per steer	597	586
Av. daily gain per steer	1.70	1.67
Feed cost per 100 lbs. gain	$18.97	$16.84
Av. selling price per cwt. based on carcass value[1]	$34.84	$33.74
Return above initial cost and feed[1]	$41.88	$42.57
Av. dressing per cent	62.17	61.06
Av. U.S.D.A. carcass grade	14.7	14.0
Marbling score[1]	6.5	7.6

[1]Includes only data from 1956-57 and 1957-58 trials. 1955-56 data was not available.

From the results of this experiment it appears that steer calves fed four pounds of grain and one pound of protein concentrate per head daily compare favorably with steers wintered in dry lot on the same concentrate feed and good quality roughage if the cost of the dry grass is low enough. They will usually produce a less desirable carcass and smaller total gain but the low charge made for the dry grass permits them to make cheaper gains and a higher return per head than the steers wintered on good quality roughage.

EXPERIMENT II

The objective of this experiment was to determine if low quality dry bluestem pasture could be used to replace good quality roughage in the wintering phase of a wintering, grazing, and fattening program for yearling steers and to determine its effect on future performance, especially with regard to the effect on the carcass produced.

Experimental Materials, Methods and Procedure

Two trials were conducted with two lots of ten steer each in each trial. The two lots were treated in an identical manner except one lot was wintered on pasture with only the grass as a source of roughage, whereas the other lot was wintered in a dry lot and was fed good quality roughage. Both lots were fed a protein concentrate in addition to roughage.

The cattle used in both trials were good to choice Hereford steers. They were purchased as calves the year prior to being

placed on experiment. The steers in Trial I originated in southwest Kansas, and in Trial II from the vicinity of Clovis, New Mexico. As calves they were wintered in dry lot, grazed on bluestem pastures during the summer, and placed on this trial between November 16 and December 11 at an average weight of 878 pounds in Trial I and 774 pounds in Trial II.

They were individually weighed two consecutive days just before the start of a trial. The average of the two weights was used in allotting them so that as nearly as possible the two lots were about equal in weight and quality.

Half of the steers in each lot, in Trial I, were implanted with 84 mgs. of stilbestrol in December of 1955. In Trial II, two of the steers in each lot were implanted with 24 mgs. of stilbestrol and three with 36 mgs. in the spring of 1956.

During the wintering phase the cattle were fed once daily. Prairie hay was fed to the pasture wintered steers when snow covered the grass. Both lots received one pound per head daily of soybean oil meal pellets during the wintering phase.

Water was heated during the winter to prevent ice forming in the dry lot pens. The ice had to be chopped and removed from the tanks in the pastures used to winter the steers on dry grass. Salt and water was provided free choice at all times in all phases.

The wintering phase was 169 days in Trial I and 151 days in Trial II. The grazing phase was the same in both trials, 68 days. They were full fed 68 days in Trial I and 100 days in Trial II.

In Trial I, three carcasses from lot 11 and four from lot 12, and in Trial II, three carcasses from lot 24 were shipped from the packing plant before carcass data was obtained from them.

The carcass data was acquired by college personnel with the cooperation of the packers buying the animals. The carcasses were graded and scored by an official United States Department of Agriculture meat grader each year.

The following United States Department of Agriculture grades for beef cattle were used: prime, choice, good, commercial, utility, cutter, and canner. Each grade was divided into a third of a grade as top, average, or low for that grade. A numerical value was assigned to each third of a grade, starting with one for low canner and working up to 21 for top prime. The higher numerical grade denoting a higher carcass grade.

For the following carcass scores a lower number denotes a more desirable characteristic.

Visual marbling of rib eye: moderate, 5; modest 6; small amount, 7; slight amount, 8; traces, 9.

Visual fat thickness at twelfth rib: moderate, 3; modest, 4; slightly thin, 5.

Visual rib eye size at twelfth rib: moderately large, 3; modestly large, 4; slightly small, 5.

Firmness of rib eye at twelfth rib: firm, 2; moderately firm, 3; modestly firm, 4; slightly firm, 5.

Per cent shrink was determined by the difference in weight at Manhattan and at the market, Kansas City, Kansas. Dressing per cent was determined by using the live Kansas City weights and

chilled carcass weights.

In Trial I, the only difference between lot 11 and 12 was during the wintering phase. Lot 11 was wintered in dry lot on sorghum silage whereas lot 12 was wintered on dry bluestem pasture. (Table 7). The protein supplement for lot 12, wintered on bluestem pasture, was discontinued April 7, 1956. Prairie hay and a small quantity of alfalfa were fed to lot 12 only when snow covered the grass. A limited quantity of prairie hay was fed to lot 11 the last six weeks of the wintering phase. Both lots were grazed together after May 3 and during the full feeding phase they were penned each morning and fed separately.

In Trial II, the only difference between lot 23 and 24 was during the wintering phase. Lot 23 was wintered in dry lot on sorghum silage whereas lot 24 was wintered on dry bluestem pasture. (Table 8). Both lots were grazed together from May 11 to July 18. During the full feeding period, July 18 to October 26, the two lots were fed in separate comparable pastures.

Table 6. Yearly feed prices for Experiment II for the years 1955-57.

Year	Sorghum Grain Per Cwt	Soybean Pellets Per Ton	Alfalfa Hay Per Ton	Sorghum Silage Per Ton	Summer Grass Per Head	Dry Grass Per Head Monthly
1955-56	$2.35	$70.00	$20.00	$6.50	$20.00	$.75
1956-57	2.50	70.00	25.00	8.00	20.00	.75
Average	2.42	70.00	22.50	7.25	20.00	.75

Experimental Results and Discussion

In Trial I, the steers fed high quality roughage in dry lot gained 1.3 pounds more per head daily for a 220 pound greater gain for the wintering period than the steers wintered on pasture, but gained 136 pounds less during the summer pasture period which greatly minimized the effect of the lower plane of nutrition during the winter.

The pasture wintered steers gained 28 pounds more during the fattening period using the same amount of feed as the steers wintered on good quality roughage. This lowered their feed cost per 100 pounds gain. They were fed grain while on grass and there was no way to determine the per cent of gain attributed to the grass.

Very poor gains were made during the first four weeks on grass by the steers wintered in dry lot which attributed to their low total summer gain of 22 pounds as compared with 158 pounds made by the pasture wintered steers.

For the entire trial the steers in lot 12, wintered on good quality roughage, gained 56 pounds more per head, shrunk 1.5 per cent less to market, dressed 1.9 per cent more, graded one-third of a grade higher, and scored more favorably on other carcass characteristics. The steers wintered on dry grass had a $5.82 lower feed cost per 100 pounds gain, sold for $.09 more per hundred weight, and returned $21.60 more per head above initial cost plus feed cost.

Table 7. Trial I. A comparison of wintering in dry lot with wintering on dry bluestem pasture for yearling steers on a wintering, grazing, and fattening program. (1955-56)

Lot number	11	12
Number of steers in test	10	10
Phase 1 - Wintering, 169 days	Dry lot	Pasture
Initial wt. per steer, lbs.	881	876
Gain per steer	264	44
Av. daily gain per steer	1.56	0.26
Daily ration per steer, lbs.		
Soybean pellets	1.0	1.0
Sorghum silage	60.8	--
Bluestem pasture	--	Free choice
Prairie hay	2.57	0.83
Salt and bonemeal	Free choice	Free choice
Phase 2 - Grazing, 68 days		
Initial wt. per steer, lbs.	1145	920
Gain per steer	22	158
Av. daily gain per steer	0.32	2.32
Phase 3 - Full feeding, 68 days		
Initial wt. per steer, lbs.	1167	1078
Gain per steer	123	151
Av. daily gain per steer	1.80	2.22
Av. daily ration per steer, lbs.		
Ground sorghum grain	11.97	11.97
Soybean meal	1.63	1.63
Ground limestone	.06	.06
Salt	Free choice	Free choice
Bluestem pasture	Free choice	Free choice
Feed cost per 100 lbs. gain	$18.77	$15.29
Summary of Phases 1, 2, and 3, 305 days		
Final wt. per steer, lbs.	1290	1229
Total gain per steer	409	353
Av. daily gain per steer	1.34	1.15
Feed cost per 100 lbs. gain	$20.83	$15.01
Av. selling price per cwt.	$20.73	$20.82
Return above initial cost and feed	$14.83	$43.87
Per cent shrink to market	3.7	5.2
Av. dressing per cent, chilled	59.34	57.38
Av. U.S.D.A. carcass grade	17.4	16.4
Marbling score	7.4	8.5
Fat thickness score	4.3	4.8
Rib eye size score	4.6	4.8
Firmness score	4.1	5.1

Table 8. Trial II. A comparison of wintering in dry lot with wintering on dry bluestem pasture for yearling steers on a wintering, grazing, and fattening program. (1956-57)

Lot number	23	24
Number of steers in test	10	10
Phase 1 - Wintering, 151 days	Dry lot	Pasture
Initial wt. per steer, lbs.	775	773
Gain per steer	115	18
Av. daily gain per steer	0.76	0.12
Daily ration per steer, lbs.		
Soybean pellets	1.0	1.0
Sorghum silage	50.7	--
Bluestem pasture	--	Free choice
Salt	Free choice	Free choice
Phase 2 - Grazing, 68 days		
Initial wt. per steer, lbs.	890	791
Gain per steer	127	151
Av. daily gain per steer	1.87	2.22
Phase 3 - Full feeding, 100 days		
Initial wt. per steer, lbs.	1017	942
Gain per steer	208	215
Av. daily gain per steer	2.08	2.15
Av. daily ration per steer, lbs.		
Ground sorghum grain	13.5	13.5
Soybean meal	1.42	1.42
Ground limestone	0.1	0.1
Salt	Free choice	Free choice
Bluestem pasture	Free choice	Free choice
Feed cost per 100 lbs. gain	$18.95	$18.33
Summary of Phases 1, 2, and 3, 319 days		
Final wt. per steer, lbs.	1225	1157
Total gain per steer	450	384
Av. daily gain per steer	1.41	1.20
Feed cost per 100 lbs. gain	$21.41	$18.09
Av. selling price per cwt.	$22.00	$21.00
Return above initial cost and feed	$14.04	$15.73
Per cent shrink to market	4.41	4.49
Av. dressing per cent, chilled	60.95	58.81
Av. U.S.D.A. carcass grade	17.5	15.3
Marbling score	7.1	8.7
Fat thickness score	4.0	3.9
Rib eye size score	4.5	4.7
Firmness score	4.0	4.4

In Trial II, the steers fed high quality roughage in dry lot gained 97 pounds more per head during the winter period than the steers wintered on pasture, but gained 24 pounds less per head during the summer pasture period and seven pounds less per head during the fattening period, which resulted in an overall 66 pounds greater gain per steer than the steers wintered on dry grass.

The steers wintered on dry grass gained seven pounds more on the same amount of grain during the fattening period which gave them a slightly lower feed cost per 100 pounds gain than the steers wintered in dry lot. Quantity of grass eaten during this period was not determined.

In the summary of the complete trial, the steers wintered on good quality roughage gained 66 pounds more per head, sold for $1.00 more per hundred weight, shrunk slightly less to market, dressed 2.14 per cent more, graded two-thirds of a grade higher, and scored higher in carcass characteristics than the steers wintered on dry grass. The steers wintered on dry grass had a $3.32 lower feed cost per 100 pounds gain and returned $1.69 more per steer.

Summary of Experiment II

The general results for both trials of this experiment were very similar. The steers wintered on good quality roughage made greater gains, produced more desirable carcasses, and sold for more per head, but the steers wintered on dry grass made more efficient gains, had a lower feed cost per 100 pounds gain, and

Table 9. A comparison of wintering in dry lot with wintering on dry bluestem pasture for yearling steers. A summary of two trials, 1955-56 and 1956-57.

Number of steers in test	20	20
Phase 1 - Wintering, 160 days	Dry lot	Pasture
Initial wt. per steer, lbs.	828	824
Gain per steer	189	31
Av. daily gain per steer	1.18	0.19
Daily ration per steer, lbs.		
Soybean oil meal	1.0	1.0
Sorghum silage	55.7	--
Bluestem pasture	--	Free choice
Prairie hay	1.28	0.41
Salt and bonemeal	Free choice	Free choice
Phase 2 - Grazing, 68 days		
Initial wt. per steer, lbs.	1017	855
Gain per steer	75	155
Av. daily gain per steer	1.1	2.28
Phase 3 - Full feeding, 84 days		
Initial wt. per steer, lbs.	1092	1010
Gain per steer	165	183
Av. daily gain per steer	1.96	2.17
Av. daily ration per steer, lbs.		
Ground sorghum grain	12.74	12.74
Soybean oil meal	1.52	1.52
Ground limestone	.08	.08
Bluestem pasture	Free choice	Free choice
Feed cost per 100 lbs. gain	$18.88	$17.08
Summary of Phases 1, 2, and 3, 312 days		
Final wt. per steer	1257	1193
Total gain per steer	429	369
Av. daily gain per steer	1.37	1.18
Feed cost per 100 lbs. gain	$21.13	$16.61
Av. selling price per cwt.	$21.36	$20.91
Return above initial cost and feed	$14.44	$26.08
Av. dressing per cent	60.15	58.10
Av. U.S.D.A. carcass grade	17.50	15.95
Marbling score	7.26	8.59
Fat thickness score	4.14	4.28
Rib eye size score	4.53	4.77
Firmness score	4.07	4.85

had a higher net return.

The steers wintered in dry lot on good quality roughage made 61 pounds greater gain per head, dressed 2.05 per cent higher, graded more than one-third of a grade higher, sold for $.45 more per hundred weight, and yielded a more desirable carcass than the steers wintered on dry grass. The steers wintered in the pasture on dry grass made faster and more economical gains on summer grass and in the feed lot but never quite make up for the poor gains made during the wintering period. In this experiment they had a $4.57 lower feed cost per 100 pounds gain and returned $11.64 more per head than steers wintered on good quality roughage.

From the results of this experiment it was found that dry bluestem pasture could be satisfactorily used to replace good quality roughage in the winter ration of yearling steers on a wintering, grazing, and fattening program if the cost of the dry grass was low enough.

SUMMARY AND CONCLUSIONS

In the final analysis of Experiment I the feasability of using dry grass as a replacement for good quality roughage in a wintering, grazing, and fattening program with steer calves was largely determined by the cost of the winter pasture.

In this experiment, the steer calves wintered on low cost dry bluestem pasture made just as great a financial return per head even though the steer calves wintered in dry lot on good quality roughage made slightly greater total gains, sold for

$1.00 more per hundred weight based on carcass value, dressed significantly more, and produced more desirable, higher grading carcasses.

In the final analysis of Experiment II it was found that dry winter grass could be used satisfactorily in the winter ration as a low cost replacement for good quality roughage in a wintering, grazing, and fattening program with yearling steers if the cost of the winter pasture was low enough.

In Experiment II, the yearling steers wintered on low cost dry grass had a lower feed cost per 100 pounds gain in the fattening phase and for the complete trial. They sold for nearly as much per hundred weight and had a $11.64 greater return per head than the steers wintered in dry lot on good quality sorghum silage. The steers wintered on the higher plane of nutrition made larger total gains, dressed two per cent more, graded nearly two-thirds of a grade higher, and in general produced more desirable carcasses.

It was found in both Experiments that dry bluestem pasture could be used successfully in a wintering, grazing, and fattening program with either steer calves or yearlings if its cost was low enough to offset the increased gains and superior carcasses produced by steers wintered on good quality roughages.

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LITERATURE CITED

Black, W. H. 1927. Wintering beef cattle in the Appalachian region. U.S.D.A. Cir. 408. 12 p.

Black, W. H. and V. I. Clark. 1938. Effect of supplementing winter and summer range on gains of beef steers in the northern Great Plains. U.S.D.A. Tech. Bul. 638. 16 p.

Black, W. H. and O. R. Mathews. 1937. Comparison of feeds for wintering steers in the northern Great Plains. U.S.D.A. Tech. Bul. 565. 10 p.

Black, W. H., J. R. Quesenberry, and A. L. Baker. 1939. Wintering steers on different planes of nutrition from weaning to two and one-half years of age. U.S.D.A. Tech. Bul. 667. 20 p.

Bohman, V. R. 1955. Compensatory growth of beef cattle: the effect of hay maturity. J. Animal Sci. 14:249-55.

Connell, W. E., S. S. Wheeler, and R. C. Tom. 1947. Effect of winter supplementation on subsequent gains of beef steers on grass and in the fattening lot. J. Animal Sci. 6:493.

Darlow, A. E., O. E. Ross, and D. F. Stephens. 1948. Effect of level of wintering of steer calves upon subsequent summer gains. J. Animal Sci. 7:536.

Duncan, H. R., C. S. Hobbs, J. H. Felts, J. W. Cole, and R. P. Moorman. 1951. Influence of wintering and grain feeding on returns from two year old and yearling grass steers. J. Animal Sci. 10:1070.

Dyer, A. J. 1952. Maximum use of roughage and pasture in producing choice two year old steers. J. Animal Sci. 11:783.

Dyer, A. J. and P. Guyer. 1950. Producing fat yearling steers utilizing maximum amounts of roughage and pasture. J. Animal Sci. 9:674.

Guilbert, H. R. and G. H. Hart. 1946. California beef production. Calif. Agri. Ext. Service Cir. 131. 157 p.

Guilbert, H. R., G. H. Hart, K. A. Wagnon, and H. Goss. 1944. The importance of continuous growth in beef cattle. Calif. Agri. Expt. Sta. Bul. 688. 35 p.

Hedrick, H. B., D. E. Brady, and A. J. Dyer. 1954. Effect of plane of winter nutrition on quality of beef. J. Animal Sci. 13:969.

Johnson, R. F., E. P. Rinehart, and C. W. Hickman. 1952. A system of wintering, pasturing and finishing beef calves for Idaho. Idaho Expt. Sta. Bul. 292. 12 p.

Kincaid, C. M. 1939. The effect of winter weight changes on gains made from pastures by beef steers. The American Society of Animal Production. 32:111-16.

Kincaid, C. M., G. W. Litton, and R. E. Hunt. 1945. Some factors that influence the production of steers from pasture. J. Animal Sci. 4:164-73.

Knapp, B., Jr., A. L. Baker, J. R. Quesenberry, and R. T. Clark. 1942. Growth and production factors in range cattle. Mont. Agri. Expt. Sta. Bul. 400. 13 p.

Lush, J. L., J. M. Jones, W. H. Dameron, and O. L. Carpenter. 1930. Normal growth of range cattle. Texas Agri. Expt. Sta. Bul. 409. 34 p.

McCampbell, C. W., B. M. Anderson, H. E. Reed, and A. D. Weber. 1940. Utilizing bluestem grass in fattening yearling steers for market. Kans. State College Agri. Expt. Sta. Cir. 40-B-1.

McCampbell, C. W. and A. D. Weber. 1942. Two methods of utilizing bluestem grass in fattening yearling heifers for market. J. Animal Sci. 1:65.

Morrison, F. B. 1956. Feeds and Feeding. Ithaca, New York. The Morrison Publishing Company. 22nd edition. 1165 p.

Nelson, A. B. and W. D. Campbell. 1954. The effect of level of wintering steer calves on their subsequent grazing performance. 28th Annual Livestock Feeders' Day Report. Okla. Agri. Expt. Sta. Pub. 114 p.

Nelson, A. B., A. E. Darlow, and W. D. Campbell. 1952. The effect of level of wintering steer calves on their subsequent grazing performance. Okla. Agri. Expt. Sta. Misc. Pub. 27. 84 p.

Nelson, A. B., R. A. Long, O. B. Ross, A. E. Darlow, and W. D. Campbell. 1951. The effect of level of wintering upon the production of two year old steers marketed off grass. Okla. Agri. Expt. Sta. Misc. Pub. 22. 96 p.

Sheets, E. W. 1924. Effect of winter rations on subsequent pasture gains of steers. Reprinted from J. of Agri. Res. Vol. XXVIII No. 12. Washington, D. C. June 1.

Sheets, E. W. and R. H. Tuckwiller. 1922. Effect of winter rations on pasture gains of calves. U.S.D.A. Bul. 1042. 15 p.

Sheets, E. W. and R. H. Tuckwiller. 1924. Effect of winter rations on pasture gains of two year old steers. U.S.D.A. Bul. 1251. 24 p.

Sheets, E. W. and R. H. Tuckwiller. 1926. Effect of winter rations on gains of calves marketed as three year old steers. U.S.D.A. Bul. 1431. 11 p.

Snapp, R. R. 1952. Beef Cattle. New York: John Wiley and Sons. Chapman and Hall: London. 4th edition. 641 p.

Stephens, D. F., O. B. Ross, W. D. Campbell, R. W. MacVican, and A. E. Darlow. 1949. Summer gains of yearling steers wintered at different levels. 23rd Annual Feeders' Day Report. Okla. Agri. Expt. Sta. Pub. 71 p.

Winchester, C. F. and P. E. Howe. 1955. Relative effects of continuous and interrupted growth on beef steers. U.S.D.A. Tech. Bul. 1108. 34 p.

THE INFLUENCE OF THE LEVEL OF WINTER NUTRITION ON THE SUBSEQUENT PERFORMANCE AND CARCASS CHARACTERISTICS OF BEEF CATTLE

by

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Steer calves and yearling steers are used quite extensively by Kansas producers in a wintering, grazing, and fattening program or some variation of it. Dry bluestem pasture is usually available during the winter and serves as a low cost roughage if properly supplemented.

The first part of this study was designed to determine if steer calves could utilize low cost, dry bluestem pasture during the winter if supplemented with several pounds of grain combined with protein and make sufficient winter gain so that they would compare favorably in total performance, especially with regard to the effect on the carcass produced, with steer calves wintered on more expensive, good quality roughage, in a program where they were to be grazed 80 to 90 days and then full fed 100 to 110 days after the wintering period.

Three trials with steer calves were conducted with two lots of steer calves in each trial, a total of 58 calves. The only difference in treatment was during the wintering period. One lot was wintered on dry grass and the other lot was wintered on good quality sorghum silage in dry lot. In addition both lots received one pound of soybean oil meal and four pounds of ground sorghum grain per head daily during the winter period.

The steer calves wintered on dry grass had a lower feed cost per 100 pounds of gain and made a greater monetary return per head. The calves wintered in dry lot generally produced higher grading, more desirable carcasses, and had a higher dressing per cent. They sold for $1.00 more per hundred weight based on carcass value but this was not enough to cover the higher wintering cost.

Yearling steers consume large quantities of roughage which may increase their feed cost considerably during the wintering phase. The second part of this study was concerned with lowering the cost of wintering yearling steers by the use of low cost winter grass, and its effect on future performance, especially with regard to the effect on carcass produced, as compared with steers wintered on good quality roughage in a program where they are to be grazed 65 to 75 days and then full fed 80 to 90 days after the wintering phase.

Two trials with yearlings were conducted with two lots in each trial, a total of 40 animals. The only difference in treatment was during the winter period. One lot was wintered on dry grass and the other lot was wintered on good quality sorghum silage in dry lot. In addition both lots received one pound of soybean oil meal per head daily. Water, salt, and minerals were supplied free choice in all phases of both experiments.

Steers wintered on dry grass had a lower feed cost per 100 pounds gain and sold for nearly as much per hundred weight which permitted them to make a greater monetary return. The steers wintered on good quality roughage made more total gain and produced higher grading, more desirable carcasses.

It was found that steer calves and yearlings could utilize dry grass during the winter in a wintering, grazing, and fattening program and make a greater monetary return if the cost of the grass was low enough, but they did not produce as desirable carcasses as steers wintered on good quality roughage.